second report of that commission has just appeared. The most important work upon which the commissioners have been engaged is that of mapping the grounds within the state limits suitable for the cultivation of oysters, and assigning the same to those engaged in that industry, upon the payment of an almost nominal fee. Natural beds, or those which have been so within ten years, are exempted from assignment. The immediate result of this policy is to give to the oystermen a property in the ground they use, protection against encroachment, and security in the possession of improvements thereon. This, in time, will largely increase the yield of this valuable food-supply, and add to the taxable resources of the state. At a time when the beds of the Chesapeake are perilously near a destruction, which, under the present conditions of folly, ignorance, and greed in those most interested, is inevitable, the action of the state of Connecticut assumes a national importance. The work of surveying the coast with the co-operation of the U. S. coast survey has been actively carried on, and in its most important features has been carried out for that part of the shore west from the Connecticut river. By the commencement of the working-season of 1883, it is believed that 90,000 acres of oyster-grounds will be held by cultivators under state jurisdiction. A new mode of cultivation, or capture of spat for seed on muddy bottoms, has been invented at Groton. Birch-trees of fifteen or twenty feet in height, and three or four inches in diameter at the butt, are thrust about three feet into the mud, with the tops under the surface of the lowest water, and inclined at an angle of some 45° with the current. The floating spat attaches itself to the branches, and grows rapidly; a single bush affording, in a few months, five to fifteen bushels of seed-oysters, none of which would have survived settling on the muddy bottom. An absurd claim was made, that these submerged bushes produced scarlet-fever and diphtheria, and many were destroyed; but the plan has recently received legal recognition, and, with proper effort, can be made to produce millions of bushels of oysters where is now only waste ground.

The oyster-business in all its branches has attained greater perfection in Connecticut waters than in any other part of the country. It is usually very profitable, but subject to unexpected and sometimes ruinous losses. Thousands of bushels of oysters have been destroyed on one patch in a week by starfish. A firm is mentioned which in two years, off Charles Island, has lost oysters valued at one hundred thousand dollars. The starfish seem to move in crowds, which scatter when they reach a bed, and devour all before them. One fisherman, while searching for them, came upon an immense bunch, and gathered in seventy-five bushels of starfish in a short time, thus saving his bed. The coot (Fulica atra), it has been discovered, feeds upon young starfish, and its protection is recommended. The drill (Urosalpinx cinereus Stimps.) and periwinkle (Sycotypus canaliculatus Gill), as well as the drumfish, are reported to do but inconsiderable damage, especially in the deeper waters. The pollution of rivers falling into the Sound, the dumping of mud dredged out of harbors, and oyster-thieving, are referred to, and legislative regulations suggested. The propagation of the oyster has been attempted, but thus far with little prospect of success, on account of the extreme minuteness and delicacy of the embryos. Without radical improvement on present methods, this branch of the subject offers no grounds for belief in its practical application to economic purposes. The report contains a map of the triangulation executed, and an appendix of statutes bearing on the general topic.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Comet (Brooks-Swift). — The spectrum of this comet was examined at Lord Crawford's observatory, Dun Echt, Scotland, on the evening of March 1, and found to be fairly bright, and to consist of the usual three bands. — (*Dun Echt circular*, No. 71.) D. P. T. [473

The mass of Jupiter. — In a paper published in the Proceedings of the Royal Swedish academy (1882), Dr. Backlund develops the formulae by which the correction to the mass of Jupiter may be derived from heliometric observations of the distances and position-angles of the satellites *inter se*, and not, as usual, from the planet. He is engaged upon a new determination of this character. The chief advantage in this method is, that measures of the star-like satellites from each other are much less likely to be affected by constant errors than are measures of the satellites from the planet. The number of unknown quantities in his final equations is twelve; six observations, at least, being required in order to obtain all the corrections to the elements. — (*Copernicus*, Feb.) D. P. T. [474

MATHEMATICS.

Complexes of the second degree. — Herr Stahl gives a synthetic treatment of certain points in connection with Kummer's sixteen-nodal quartic surface. The processes are new; but, for the most part, the results are well known. — (*Journ. reine angew. math.*, xciii.) T. C. [475

Rotation of a liquid ellipsoid. — In two articles Mr. Greenhill has examined the conditions to be satisfied in order that a liquid ellipsoid may rotate about an axis other than a principal axis, and have a free surface. The axis of rotation, as stated by Riemann, lies in a principal plane of the ellipsoid. The motion is supposed to be set up in the liquid by mechanical processes; and the pressure at any point is investigated, the liquid being supposed contained in a rigid shell. The conditions are then investigated that are requisite for the ellipsoidal shell to be a surface of equal pressure, and that a free surface can exist. — (*Proc. Cambr. phil. soc.*, 1882.) T. C. [476

Non-Euclidean geometry. — Dr. Story has shown, in a previous paper, how the formulae of a non-Euclidean plane trigonometry could be deduced from those of the Euclidean spherical trigonometry; viz., by the replacement of each side by a constant multiple of that side, and each angle by a constant multiple of that angle. In the present paper he makes the corresponding deduction for any non-Euclidean spherical trigonometry, and also gives a number of formulae relating to distances, areas, etc. A new and important principle is exhibited; viz., *the distance (or angle) between any two geometrical elements (points, planes, or straight lines) is, to a constant factor près, the same, in whatever way it is measured.* For example, the formulae show that the distance of a given point from the nearest point in a given plane is proportional to the angle between the given plane and the nearest plane through the point (i.e., that which makes the least angle with it); the least (or greatest) distance from a point of one of two given straight lines to a point of the other is proportional to the least (or greatest) angle which a plane through one of the straight lines makes with a plane through the other; and, if the lines intersect, this is proportional to the angle between the lines, etc. Expressions are given for the circumference and area of any circle, the area of any spherical polygon, the surface and volume of any sphere; it is also shown that the double plane is identical with a sphere of *quasi*-infinite radius. A further abstract will be given on the completion of the paper. — (*Amer. journ. math.*, v.) T. C. [477

PHYSICS.

Acoustics.

Vibratory movement of bells. — Mathieu has recently studied the vibrations of bells, with a preliminary investigation of the vibrations of bent bars, considering the case of an ordinary bell in which the thickness in any meridian increases from summit to base. Between the vibratory movement of a bell and that of a plane plate, the essential difference exists, that, while in the latter the longitudinal or tangential movement and the transverse movement are given by independent equations, in the former, the normal and tangential motions are given by three equations which are not independent. The pitch of the notes of a bell does not change if the thickness varies in the same relation throughout every part: since the terms depending on the square of the thickness may be neglected; at least, for the graver partials. It is impossible to construct a bell so that it shall vibrate only normally; and, with a hammer, the tangential vibrations are of the same order as the normal vibrations. A purely tangential motion can be realized only with a spherical bell of constant thickness. — (*Journ. de phys.*, Jan.) C. R. C. [478

Vibrations of solid bodies in contact with liquids. — F. Auerbach has investigated the effect of liquid contained in a glass vessel upon the pitch of the sound produced when the latter is set into vibration. He reaches the following results: 1. The geometrical lowering in pitch (ratio of number of vibrations), produced by a liquid contained in a cylindrical glass completely filled by it, is less in proportion as the pitch of the empty glass is higher. 2. The arithmetical lowering of pitch with a cylindrical glass of mean pitch is approximately proportional to the reciprocal of the square root of the number of vibrations of the empty glass. 3. The lowering of pitch, when the glass is completely filled, is not noticeably dependent on its height. 4. The geometrical lowering of pitch produced in cylindrical glasses of different widths is greater in proportion as the glass is narrower. 5. The arithmetical lowering of pitch with cylinders of different widths is inversely as the square root of the width. 6. The arithmetical change of pitch is inversely proportional to the square root of the number of wave-lengths of the sound given by the empty glass contained between the walls and axis of the cylinder. 7. The lowering of pitch is greater as the density of the liquid is greater. 8. It is greater in proportion as the compressibility of the liquid is less. — (*Ann. phys. chem.*, 1882, xiii.) C. R. C. [479

Optics.

(*Photometry.*)

Solar photometry. — M. A. Crova has recently made some comparisons of the relative brilliancy of the sun and of a Carcel lamp. He compared the lighting-power of different wave-lengths in the two spectra, thereby deducing curves for each. The areas enclosed by these curves then represented the total amount of light given out by each source. He then deduced the factor by which it was necessary to multiply the smaller ordinates in order to render the two areas equal. The ordinate of intersection of the two curves of the same area then furnished at once the wave-length whose photometric comparison would give the ratio of the total light emitted by the two sources. This wave-length (582) is situated in the yellowish-green, and may be isolated by transmitting the light through a mixture of the solutions of perchloride of iron and chloride of nickel. The two lights thus obtained were of precisely the same color, and their ratio was at once determined by measurement with a Foucault photometer. After making all corrections, this method gives about 60,000 carcels (600,000 candles). — (*Comptes rendus*, Dec. 18, 1882.) W. H. P. [480

Electricity.

Electric amalgamation. — In the process of obtaining gold by amalgamation from ores containing arsenic and certain other impurities, the mercury 'sickens,' and fails to take up all the gold present. Mr. Richard Barker has devised a method of amalgamation which has given very satisfactory results. The inclined table over which the ore is washed contains hollows filled with mercury; over these, in the water containing the washings, copper wires are introduced, and brought so near that a powerful current may be passed to the mercury, which seems to gather itself away from the impurities, and to act more energetically upon the ore. — (*Iron*, Feb. 9.) J. T. [481

Relation between viscosity and galvanic resistance. — Mr. L. Grossman applies formulas deduced by him in a former article (*Ann. phys. chem.*, 1882, xvi.) to the analysis of experiments made by Grotrian, Kohlrausch, and others, on the temperature curves of internal friction and galvanic resistance in fluids, obtaining what he considers accurate determinations of twenty-five temperature co-efficients for each of these properties in solutions of six different salts; hence he concludes, that, for these solutions, the temperature curves of these two properties are equal. — (*Ann. phys. chem.*, 1883, i.) J. T. [482

Molecular theory of magnetization. — D. E. Hughes, in a lecture before the Institution of mechanical engineers, says that if a coil be placed at right angles with a plane circuit containing a soft iron wire, which passes through the centre of the coil, torsion of the wire induces currents in the coil which are reversible with the direction of torsion, but independent of its amount. A steel core does not respond in this way to torsion: hence, by analogy of the effects produced by inclining the core to the plane of the coil, the lecturer argues a greater molecular rigidity in steel than in iron. Attention was called to the fact that the coercive power of iron is greater than that of steel if the inducing forces are 'within the range of iron.' Iron, on being twisted or subjected to longitudinal vibration, lost its magnetism, steel did not. The magnetic properties of iron were illustrated by a glass tube containing iron filings, which lost its residual magnetism on being shaken or carefully rotated. The greater molecular rigidity of iron alloys was compared to the properties of the tube when petroleum was poured in among the iron filings, greater coercive power being thus attained. These facts go to support the theory that steel is an alloy of iron and carbon. — (*Iron*, Feb. 2.) J. T. [483

ENGINEERING.

Stability of brick conduits. — Mr. A. Fteley contrasted the theory on which the designing of brick conduits is based with the actual conditions under which such structures are built. Sewers and conduits are often built in ground more or less yielding, and the action of the earth about them is an important element of their stability. Under such conditions, such structures must move more or less after being built, and the conditions of stability must be very different from what they appear to be from a study of the original drawing. A study of the changes of form, by means of exact measurements made during construction, might point to defects due to the design or mode of construction, to the ground in which the sewer or conduit is built, or to the want of care or skill in the builder.

The author presented a diagram of an apparatus, showing, *in full size on a section drawn at a small scale*, all the deviations of the brick-work from the true line of section. The exaggerated distortion of the outline defines very clearly the slightest defects in construction or the movement of the structure. Diagrams were exhibited showing distortions in a conduit nine feet in width and seven feet eight inches high, and were taken at points where the conduit was built in firm, dry ground, in yielding ground, in wet trenches, on platforms in swampy land, and on high artificial embankments. From these diagrams and the distortions they exhibited, the defects in construction and design, in different locations and under different loads, were explained. The tendencies of the structure to spread under different conditions was alluded to; also the section of excavation on yielding ground best suited to prevent movement.

An instance of the successful underpinning of a brick conduit was described. A large quantity of water broke in between the outside of the brick-work and the sheet-piling supporting the trench, and washed away the sand forming the foundation for a length of about thirty feet, leaving it without support for that distance. A very simple and efficient means was described by which this space was filled with a grout of Portland cement. — (*Bost. soc. civ. eng.; meeting* Feb. 21.) [484

Steel castings. — M. A. Pourcel described recently, before the Iron and steel institute of Vienna, a series of experiments upon steel castings. He stated that the chief points to which attention is now directed are, increase in the size of the castings, and improvements in the methods of annealing and tempering in order to endue the casting with the highest mechanical qualities corresponding to the chemical composition. The last progressive step was the casting of cylinders for a Paris firm, 2.04 m. in diameter, over 2 m. long, and 55 mm. thick. These cylinders supported a pressure of forty-five atmospheres without showing signs of percolation. — (*Engineering*, Dec. 8, 1882.) G. A. H. [485

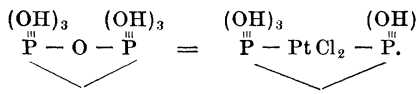
Screw-propeller blades. — The use of manganese bronze as a material for screw-propeller blades is rapidly extending. The first run of the 'Alaska' from Queenstown to New York in less than seven days was made immediately after her steel blades had been replaced by blades of manganese bronze. The great qualities of manganese bronze are its strength, and its freedom from corrosion. Recent experiments show that it has a transverse strength about double that of gun metal, and also, up to the elastic limit, double that of steel. The cost of manganese bronze is about double that of steel; but it is claimed that propeller-blades made of the bronze will last during the lifetime of the vessel, while steel blades require renewal every three years. — (*Engineering*, Jan. 5.) G. A. H. [486

CHEMISTRY.

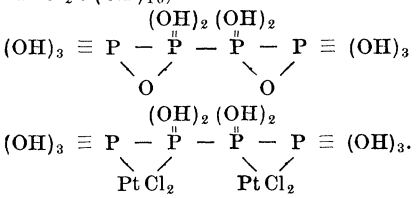
(General, physical, and inorganic.)

Formation of carbonic oxide. — Dr. L. P. Kinnicutt suggested a modification of Noack's method (*Berichte deutsch. chem. gesellsch.*, xvi. 75) for the preparation of carbonic oxide. He found that this gas was freely evolved when magnesia alba was heated in a retort with zinc-dust, and that it contained a small percentage of carbonic dioxide. — (*Harvard chem. club; meeting* March 13.) [487

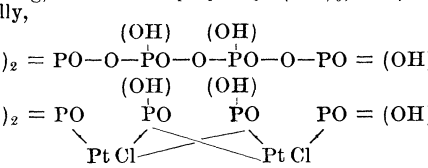
On the probable existence of new acids containing phosphorus. — Concerning the replacement of oxygen by platinous chloride in certain forms of phosphoric acid, Prof. W. Gibbs made the following suggestions: "Schützenberger described, some years since, a remarkable series of compounds in which platinous chloride ($PtCl_2$) replaces a molecule of chlorine or an atom of oxygen. Thus we have $PCl_3 . PtCl_2$ chemically equivalent to PCl_5. The corresponding acid is $P . PtCl_2 . (OH)_3$, which may be regarded as a derivative of $PO(OH)_3$. The same chemist obtained three other analogous acids, having respectively the formulas $P_2 . PtCl_2 . (OH)_6$ (corresponding to the chloride $2PCl_3 . PtCl_2$), $P_2 . PtCl_2 . (OH)_5$, and $P_2O_2 . PtCl . (OH)_3$. In all these cases we have the chemical equivalence $PtCl_2 = 2Cl = O$. Hence, following up the relation suggested by the equivalence expressed by $P . PtCl_2 . (OH)_3 = P . O . (OH)_3$, it seems at least probable that there are modifications of phosphoric acid expressed by the structural formulas, —



The formula $P_2 . PtCl_2 . (OH)_5$ is structurally unsymmetric, and must be doubled; so that we have $P_4 . 2PtCl_2 . (OH)_{10}$, or



Finally, in the acid $P_2O_2 . PtCl . (OH)_3$, we have $PtCl = 3Cl$, and therefore $2PtCl = 3O$. Hence, doubling, we have $P_4O_4 . O_3 . (OH)_6$, and, structurally,



It is easy to see that in the last four acids we may expect to find a marked influence of *position*, depending upon the different modes of union of the hydroxyl." — (*Harvard chem. club; meeting* March 13.) [488

METALLURGY.

Action of sunlight upon silver amalgamation. — By the process as usually conducted, native sulphide of silver is converted into chloride by treatment with mixed sulphate of copper and common salt. The chloride so formed is decomposed and amalgamated by mercury. M. P. Laur, of Rodez, has investigated this matter in the laboratory. In a glass vessel he placed a solution of common salt and sulphate of copper; a porous vessel filled with mercury was suspended in it, and a platinum electrode dipped into the mercury; the second electrode was a leaf of sulphide of silver, and was dipped into the copper solution. The electrodes were connected with a galvanometer, and the needle was found to swing according to the intensity of the light. The cupric chloride was changed by the mercury to cuprous chloride; and the latter acted upon the silver sulphide only in the presence of sunlight. — (*Iron*, Dec. 22, 1882.) R. H. R. [489

Petroleum as a blast-furnace fuel. — E. W. Shippen, of Meadville, recently built a small blast-furnace for testing petroleum. The furnace was 35 ft. high, 3 ft. hearth, 5 ft. bosh. It was fired with dried wood, iron-ore, and limestone. Hot oil was injected at the tuyeres under 16 lbs. pressure in the form of a spray. The white-hot charcoal, when struck by the hot oil, turned as black as if cold water had been thrown upon it. The experiment does not appear to have been a success. — (*Iron*, Dec. 29, 1882.) R. H. R. [490

Aluminum. — A recent patent by Mr. Morris of Uddington, N.B., claims to have solved a problem which has long baffled the skill of technical chemists. By heating an intimate mixture of alumina and charcoal in a current of carbon dioxide, Mr. Morris says that metallic aluminum is produced. The metal is purified from carbon and alumina by a second fusion. — (*Nature*, Dec. 21, 1882.) R. H. R. [491

GEOLOGY.

Lithology.

Crystals of serpentine. — Professor H. C. Lewis called attention to some interesting crystals of serpentine which occur in deweylite from Way's felspar quarry, Delaware. The crystals have a gray color, a pearly lustre, and an eminent basal cleavage almost micaceous. They polarize light, and are optically biaxial with a small axial angle, being probably orthorhombic. The blowpipe examination and analysis proved the mineral to have the composition of serpentine. The deweylite contains rounded masses of felspar partially altered into deweylite, together with sharp cleavage fragments of quartz, such as would be produced by throwing a heated crystal of quartz into cold water. The micaceous serpentine was the result of the alteration of mica, but, being crystallized, was not a true pseudomorph. The two points to which he desired to call special attention were the occurrence of serpentine in the crystallized state, and the direct alteration of graphic granite into magnesian minerals. — (*Acad. nat. sc. Philad.; meeting* March 13.) [492

MINERALOGY.

Bournonite. — A mineral resembling tetrahedrite, from Park county, Col., analyzed by W. T. Page, agreed essentially in composition with bournonite, and can be regarded as a variety in which most of the lead has been replaced by copper and zinc. — (*Chem. news*, xlvi. 215.) S. L. P. [493

Dopplerite. — Very carefully selected material of this organic mineral from Aussee, in Styria, has been investigated by W. Demel. He shows that the ash consists mostly of oxide of calcium, which is in chemical combination with the organic substance. The composition of the whole cannot be expressed by a simple formula; but the organic part is of an acid nature, agreeing with the formula $C_{12}H_{14}O_6$. — (*Berl. berichte*, xv. 2961.) S. L. P. [494

Native iron. — Small grains of iron accompanying gold from the gold-washings in Brush creek, Montgomery county Va., have been analyzed by W. T. Page. Absence of cobalt and nickel shows that they are probably not of meteoric origin; and evidence is given that they are grains of native iron, and not derived from the tools of workmen. Similar grains have also been separated and analyzed from auriferous sand from Burke county, N.C. — (*Chem. news*, xlvi. 205.) S. L. P. [495

Fergusonite. — This mineral, in fragments of tetragonal crystals from Burke county, N. C., has been analyzed by W. H. Seamon. From the analysis he derives the ortho-niobate formula $R'''NbO_4$. — (*Chem. news*, xlvi. 205.) S. L. P. [496

Orthite. — This mineral from Mitchel county, N.C., occurring in flattened crystals, has been analyzed by W. H. Seamon. The results of analysis showed a very small content of the cerium metals and a large quantity of calcium oxide. The formula derived was that of an ortho-silicate. — (*Chem. news*, xlvi. 215.) S. L. P. [497

Mimetite. — Colorless crystals of this mineral from Eureka, Nev., gave F. A. Marsie, upon analysis, the usual formula, $3Pb_3As_2O_8$, $PbCl_2$. — (*Chem. news*, xlvi. 215.) S. L. P. [498

METEOROLOGY.

Barometric laws. — An important contribution to this branch of meteorology has been made by Dr. Köppen of the Deutsche seewarte. Reviewing the work of Ley, as expressed by him in the eleven pos-

tulates published in 'The laws of the winds prevailing in western Europe,' he claims that three of these have been shown to be incorrect, while the others are confirmed. For these three he would substitute the following: "Mountainous regions, in spite of the copiousness of their rains, are visited by centres of depression more rarely than the surrounding lowlands and seas, — in general, there is not wholly wanting some influence of precipitation upon the depression; but this influence is not yet clearly defined, and in any case is but indirect."

Recent meteorological investigations justify the enunciation of four new theorems, which the author gives as follows: 1°. The direction of air-currents, in our latitudes, at the distance of from 500 to 3,500 metres from the earth's surface, is, on the average, nearly parallel to the isobars of that layer; in the lowest stratum it deviates from 0 to 8 points towards the side of the lower pressure, and, in the layer from 3,500 to 9,000 metres from the earth, from 0 to 2 points towards the side of the higher pressure, from the isobars of the respective layer. 2°. Since the pressure decreases with the altitude more slowly in warm than in cold air, the gradients, independent of their ratio to the pressure, are changed, as we ascend, in such a manner that an excess of pressure exists upon the side of the warmer air-columns. 3°. The advance of the depressions takes place approximately in the direction of that air-current, within it and approaching its path, which has a preponderance of accumulated energy. 4°. Since the conditions of motion at different heights of the vortex are different, there is required for its onward movement, not the state of motion of the lowest layer, but that of the sum total of layers. As the changes are continuous with the height, the state of motion of a certain mean layer, whose height is still to be determined, can in general be substituted for it. In support of these propositions, the author refers in detail to the works published in recent years by Terrel, Hann, Guldberg, Mohn, and others, and thus incorporates the results of the leading meteorologists of the present day. — (*Ann. hydr. und marit. meteor.*, 1882, heft xi.) W. U.

[499

Pressure of the wind. — An apparatus for measuring the pressure of the wind, which promises good results, is suggested by Dr. Sprung of Hamburg. It consists essentially of a hollow metallic sphere erected upon the top of a long rod, which is suspended at a point just above the centre of gravity of the apparatus. Pressure upon the ball is communicated to the rod, and may be recorded by a suitable registering-cylinder. — (*Repert. exp. phys.*, xviii. heft 12.) W. U.

[500

PHYSICAL GEOGRAPHY.

Australia. — The physical structure and geology of Australia is well summarized by Rev. J. E. Tenison-Woods. The southern side is low, or bounded by cliffs three hundred to six hundred feet high; the west is a tableland about a thousand feet in height; the north is a little higher; and the east averages two thousand feet elevation, and, near the south-eastern angle, bears the Australian Alps, with summits from six thousand to seven thousand feet. The interior depression is eccentrically placed near these mountains, and from them the slopes are sufficient to form the only large river-system of the continent. Elsewhere, whatever rain falls on the interior plains soon collects in shallow marshes, which are generally salt. Granite occupies most of the border-tablelands, but is sometimes replaced by vertical paleozoic or older slates and schists. These remain from a very ancient disturbance which had no connection with the present outline of Australia, and are at places overlaid by mesozoic strata. The great depression contains cretaceous strata, overlaid along the southern shore by a full series of marine tertiary deposits reaching three or four hundred miles inland, and as much as six hundred feet above sea-level. About contemporaneous with their rapid uplift a subsidence occurred, forming the castellated fiords and diversified scenery of Port Jackson, Broken Bay, etc. Extensive volcanic overflows are common nearly all around the tableland, and generally determine the direction of modern drainage. Their date is mostly miocene; but west of Melbourne they are much more recent, and ash cones and craters are frequently preserved. There are also scattered isolated masses of cross-bedded sandstone, forming flat-topped mountains, bordered by precipitous cliffs, so characteristic of Australian scenery. These are ranked as tertiary, or older eolian deposits, and are sometimes a thousand feet thick. Other land-formations are the tertiary drifts — often containing gold from the disintegration of the Cambrian and Silurian rocks, and sometimes buried under heavy lava-flows — and the recent sands and clays of the level half-desert regions derived from the weathered granite, covering a great part of the country. The sand lies in ridges, separated by the yellow clay flats, which a little rain makes very boggy.

The narrow strip of land between the plateau and the sea is generally well enough watered by streams to possess fertile alluvial plains, occupying most of its area. On higher ground the volcanic rocks, fortunately of considerable extension, yield the best soils. The colony of Victoria has the greatest share of these. Farther inland the lands are, as a rule, poor, except in river-valleys; and toward the central basin of the continent they are desert, like the Sahara. There seems to be good probability that artesian wells may be sunk here successfully. This is indicated by the occurrence of springs within the central depressed area. Their water is warm, indicating a deep source, and a supply from the slopes of the surrounding tableland. They form travertine deposits, in which the remains of gigantic marsupials are found. The paleontological evidence of the age of the several formations above named is given with some detail. — (*Proc. Linn. soc. N. S. Wales*, vii. 1882, 371.) W. M. D.

[501

Physical features of the Australian Alps. — A paper with this title, by J. Stirling, gives some introductory particulars of this range, about lat. 37° S., preparatory to further account of its geology and botany. Its culminating peak is Mount Kosciusko (7,256 feet), with companions in Mounts Bogong (6,508), Feathertop (6,308), and Hotham (6,100). These carry snow-patches through the summer. Below them are numerous plains at altitudes from 3,000 to 6,000 feet, possessing distinctly alpine features. In midsummer (February), when the lower valleys are languishing in excessive dryness, the rich volcanic soil of these flat highlands bears a luxuriant growth of alpine flowers and snow-grasses, giving excellent pasturage. During the rest of the year their climate is inhospitable, having sudden changes, severe frosts, and heavy snows. The present dividing-range is not regarded as the original axis of elevation, but has assumed its form by the erosion of a great miocene highland north and south of it, now remaining as isolated peaks, — Wills, Gibbo, Bindi, Baldhead, and others. The basis of this plateau is of crystalline schists and Silurian strata, overlaid by deposits containing miocene plants capped with basaltic flows, into all of which the rivers have cut

deep gorges. The rain, brought by southerly winds, was 58.59 inches on 154 days in 1880 at Grant (3,700 feet above sea-level in the basin of Mitchell River, south of the dividing-range), and 29.92 inches on 114 days in the same year at Omeo (2,108, altitude north of the range). The article is chiefly devoted to the detailed topography of the Mitta Mitta basin north of the divide. — (*Trans. roy. soc. Victoria*, xviii. 1882, 98.) W. M. D. [502

GEOGRAPHY.

(*Asia.*)

Northern Persia. — A plane-table route survey from Tehran to Astrabad, by Lieut.-Col. Beresford Lovett, British consul at the latter place, gives a considerable addition to the knowledge of the topography of that region. His way led generally along the northern slope of the Elbruz mountains, continually crossing over passes between valleys opening northward to the Caspian. Notes are given on the altitudes, distances, and roads between stopping-places; the character of the towns, and the supplies they afford; and very briefly on the appearance and structure of the country. On nearing Astrabad, the northern mountain slopes were found covered with luxuriant forests of elms, oaks, and beeches; but, on crossing the Shahwar mountains, on a second trip south-east from Astrabad to Shahrud, the country was found very dry and barren. At other points it was noticed that the moist winds from the Caspian formed clouds only on the northern sides of the mountain-ranges. It was found that the plains of the Lar (Harhaz) river, southwest of the great volcano Demavend, were formed as lake-beds during a time when lava-flows south of the volcano held back the river. A gorge has since been cut through the barrier, so that the lake has now disappeared. No granite or 'trap rock' was seen. The mountain summits were of compact limestone; and the valleys showed marls, sandstones, and shales. A geological section of very doubtful value is given of the mountains south of Astrabad. — (*Proc. roy. geogr. soc.*, 1883, 57; map.) W. M. D. [503

Eastern Turkestan. — This region was visited from India by Shaw in 1872, who was well received by the local authorities, and found good opportunities for trade; but further attempts at intercourse were stopped by the Mohammedan rebellion under Yakub Beg (Atalik Ghazi) against the Chinese. While this movement was successful, Sir Douglas Forsythe's mission crossed the mountains, and again found encouragement for commercial enterprise. A second interruption came on the defeat and death of Yakub Beg, and the reconquest of eastern Turkestan by the Chinese. Two years ago Ney Elias, British resident at Leh in Ladak, made the same trip, and met with no opposition. Lastly, Mr. A. Dalgleish, a merchant in India, conducted a trading-caravan across the mountains, and staid ten months in Kashgar, where he was well received, and successfully disposed of his goods. He has lately returned, and proposes to go again. — (*Athenæum*, Feb. 10.) W. M. D. [504

Tibet and the Sanpo. — One of the pundits trained for trans-Himalayan exploration has lately returned to India, with all his journals and instruments, after an absence of four years, in spite of the report, previously received, that his legs had been broken to prevent his further travels, and that his companion had been executed by the authorities at Lhassa. He was twice robbed of nearly all his property, and was twice forced to work for his support; but he took many observations for latitude, and recorded much of his route. After leaving Lhassa, the attempt was made to reach Lob-nor (Prejevalsky had not then been there). The farthest points reached were Saithang and Saitu (lat. 40°, long. 92°), thus failing of the object only by a comparatively short distance. On returning, he went to Batang, and desired to cross into Assam, but turned back, as savage tribes were reported on the frontier, and went westward toward Lhassa, stopping short of this place, however, for fear of being recognized there, and crossing the Sanpo at Tchetang. Gen. Walker, of the Indian survey, regards the route followed from Batang as giving good evidence that the Sanpo does not join the Irawadi: for, if it did, the pundit must have crossed it three times; while he is confident that he crossed it only once, and that a great range of hills cuts it off from the rivers on the east. — (*Proc. roy. geogr. soc.*, 1883, 99.) W. M. D. [505

(*Pacific Ocean.*)

Arctic currents. — Professor Davidson read a paper, prepared by Capt. Hooper, who commanded the 'Corwin' in the Arctic, upon the currents determined in his last cruise in Bering Sea, Bering Strait, and the Arctic Ocean south of Herald Island. The data were abstracted from the records of the vessel, and demonstrated the prevalence of a current setting through the Bering Strait to the Arctic. The observations were specially directed to this point; and Capt. Hooper's experience of the previous year, and his appreciation of the difficulties attending the question, add special value to his deductions on this question. The president recalled the results of former observations, weighing their relative values, and gave the fullest credit to the 'Corwin's' work. — (*Proc. Calif. acad. sc.; meeting* March 5.) [506

BOTANY.

Freezing of liquids in living vegetable tissue. — Mr. Thomas Meehan referred to the prevalent opinion that the liquid in vegetable tissues congeals as ordinary liquids do, and, expanding, often causes trees to burst with an explosive sound. Experiments on young and vigorous trees varying from one foot to three feet in diameter demonstrated that in no instance was there the slightest tendency to expansion; while, in the case of a large maple (Acer dasycarpum) three feet eleven inches and a half in circumference, there appeared to be a contraction of an eighth of an inch. In dead wood soaked with water there was an evident expansion; and the cleavage with explosion, noted in the case of forest-trees in high northern regions, may result from the freezing of liquid in the centre or less vital parts of the trunks. In some hardy succulents, however, instead of expansion under frost, there was a marked contraction. The joints or sections of stem in Opuntia Rafinesquei and allied species shrink remarkably with the lowering of the temperature, so that the whole surface in winter is very much wrinkled. Assuming as a fact that the liquids in plants which are known to endure frost without injury did not congeal, it might be a question as to what power enabled this successful resistance. It was probably a vital power; for the sap of plants, after it was drawn from them, congealed easily. In the large maple-tree already referred to, the juices not solidified in the tree exude from the wounded portion, and then freeze, hanging from the trees as icicles, often six inches long. — (*Acad. nat. sc. Philad.; meeting bot. sect.*, March 13.) [507

Autoxidation in living vegetable cells. — Traube has given the name '*autoxydable körper*,' or, as we must clumsily translate the new term, autoxidizable substances, to those bodies which, at a low

temperature, and by the action of free, passive oxygen, can be oxidized, forming, in the presence of water, peroxide of hydrogen. Starting from Traube's statement of the changes which accompany oxidation, especially the formation of peroxide of hydrogen, Prof. Reinke gives the following as a sufficient basis on which to build a theory of oxidation in living cells. (He has himself shown that there exists in certain plants, notably in the beet, a very easily oxidizable body, which he has named rhodogen. This substance is one of Traube's autoxidizable bodies, and is only one of many which may be reasonably assumed to be present in cells.)

1. In every active cell, autoxidators are formed; that is, substances which, at a low temperature, and by the action of molecular oxygen, can be oxidized in the presence of water.

2. By oxidation of these substances, peroxide of hydrogen is produced.

3. This peroxide of hydrogen can, under the influence of diastase, and probably of other ferments, cause further oxidations, just as atomic oxygen can.

Lastly, the seat of this activity is the periphery of the protoplasmic body of the cell; and this body possesses an alkaline reaction. — (*Bot. zeit.*, Feb. 2 and 9, 1883.) G. L. G. [508

Structures which favor cross-fertilization in certain plants. — Several are made known and discussed by Trelease. The protogyny, development of the anthers one after the other, and usual cross-fertilization by the jostling of the little plants caused by surface-currents of the water, are well made out. The singular arrangement in Hakea and other Proteaceae is worked out with new particulars; also a curious explosive arrangement in certain heaths, a new study of Salvia, and some remarkable arrangements in two Acanthaceous flowers, in one of which a slow change of position, in the other an irritable movement, insures cross-fertilization. The flowers were studied at the Botanic garden, Cambridge. — (*Proc. Bost. soc. nat. hist.*, March, 1882.) A. G. [509

(*Fossil plants.*)

Fossil wood from India. — Prof. A. Schenck enumerates the specimens of fossil wood collected in the East Indies by the brothers Schlagintweit. The greater number of these specimens, twenty, pertain to gymnospermous trees; one species represented by six specimens being identified as Nicolia aegyptiaca, Ung., which was originally described from the wood of the fossil forest of Egypt. Of the other specimens five are conifers, and two monocotyledonous, — palms. Of the conifers four specimens are described under the name of Araucaroxylon Robertianum, the other as Cedroxylon Hermanni. The two specimens of palms represent different species. — (*Engler's bot. jahrb.*, iii. 353.) L. L. [510

Cotta's species of Perfossus. — Prof. A. Schenk records the result of his researches on the original specimens, which Cotta had compared or referred to palms from the distribution of the fragments of fossil wood in the tertiary. The specimens do not appear to have been critically examined since Cotta, the names only being changed: Perfossus angularis, Ung. and Stenzel, for Perfossus; and Palmantes perfossus, Schimper, for Fasciculites perfossus. Perfossus costatus, Cotta, has not been mentioned by Schimper and Stenzel; Unger refers it to corals. From the researches of Prof. Schenk, it appears that the specimens from which Perfossus punctatus has been constituted by Cotta, represent two different species, — Stenzelia elegans, Goepp. (medullosa, Cotta) of the Cycadeae, and a species of palm, probably of the genus Phoenix. — (*Engler's bot. jahrb.*, iii. 484.) L. L. [511

ZOÖLOGY.

Coelenterates.

Peculiar method of budding in the Campanularidae. — The well-known tendency shown by certain hydroids, when kept in confinement, to throw out long tubular processes, which may subsequently become the foundations of new communities, is described in detail by Dr. Lendenfeld as exhibited in Campanularia and Gonothyraea. — (*Zool. anz.*, No. 130.) W. K. B. [512

Observations on Australian hydroids. — Dr. Lendenfeld writes that he has independently discovered in Australian Campanularidae the glandular ring which has been described in Eudendrium by Weissman and Jickeli. He has also verified the existence of Jickeli's 'ganglion-cells;' and he finds similar cells in the endodermal lining of the proboscis, where they are very numerous. The processes which they give off anastomose with each other so as to build up a definite 'nerve-ring' around the mouth. Lendenfeld regards this as the true central nervous system of hydroids. If these star-shaped corpuscles of hydroids are really nerve-cells, we have in these animals a central nervous system which is endodermal in its origin, and which is not homologous with the nerve-ring of the hydro-medusae. In the Campanularidae the endodermal ganglion-cells of the proboscis are joined to sensory cells, each of which carries a sensory hair projecting into the digestive cavity. — (*Zool. anz.*, No. 131.) W. K. B. [513

Mollusks.

Soft parts of Ammonites. — At the November meeting of the Liverpool geological association, a paper on Ammonites and the Aptychus was read by Mr. F. P. Marrat. That gentleman, after reviewing the subject as treated by others, concluded that it is probable that some species of Ammonites, perhaps those protected by a deep-water habitat, were destitute of these appendages, while others, perhaps littoral in their range, and more subject to attacks from predacious enemies, were provided with them. He considers them as opercular attachments to a 'hood' such as exists in Nautilus. Both calcareous and horny Aptychi have been found *in situ*. They are generally smooth or slightly striated; but in the Free public museum of Liverpool is a very fine example, from the lithographic slate of Solenhofen, with a distinctly granular surface, recalling that of the thick, granular hood of Nautilus. The appearance of the edges of the valves in this specimen, beautifully preserved, indicates that its margin was not free, as in gastropod opercula, but that it was partly imbedded in a cartilaginous lobe which fitted the margin of the aperture like the wavy margin of the hood in Nautilus. In this view the hypothesis that Ammonites were internal shells, like Spirula, would seem to be quite untenable, as no internal shell is known which has any opercular apparatus. — W. H. D. [514

Crustaceans.

Heterogenesis in Copepoda. — Under this title, C. L. Herrick, after calling attention to the wide geographical range of some species of Copepoda, and giving instances of species common to the fresh waters of Europe and North America, describes forms of Cyclops and Diaptomus apparently due to abundance of food, and other conditions of environment. In another note the same author refers to a blind non-

parasitic copepod, which he refers to the genus Braydia. — (*Amer. nat.*, Feb., 1883.) S. I. S. [515

Supposed larva of Limulus. — In his letters from the Challenger, the late Dr. von Willemoes-Suhm referred to a larva taken in the East Indies, supposed to be that of Limulus, but which he is said to have concluded afterwards to be the larva of some cirriped. Willemoes-Suhm's original figures and description of the larva are now published with a brief preface by E. Ray Lankester. The figures show that the later conclusion was undoubtedly correct, though the larva is very different from any cirriped larva previously figured. — (*Quart. journ. microsc. sc.*, Jan., 1883.) S. I. S. [516

Insects.

Sexual dimorphism in Psocidae and their salivary glands. — Besides the doubtful case mentioned by Westwood (Lachesilla), no instance of sexual dimorphism has so far been noted in the Psocidae. Bertkau now describes Psocus heteromorphus, in which the female has very rudimentary wings, while the male has wings longer than the body. Two new genera, Trocticus and Lapithes, are described and figured in the same paper. Kolbe, however, a few months earlier, described P. heteromorphus as Neopsocus rhenanus, and Lapithes as Bertkauia. — (*Katter's ent. nachr.*; *Arch. f. naturg.*, xlix. 97; *Herbstversamml. naturh. ver. Bonn*, 1882.)

In the latter place Bertkau also discusses Burgess's so-called 'lingual glands' of Psocus and Atropos, regarding them simply as strongly chitinized areas of the mouth-cavity, possibly serving as salivary accumulators. Bertkau succeeded in finding in Psocus the true salivary glands, which Burgess, in alcoholic specimens, could not demonstrate. There are two pairs of them, each pair with a common duct. No figures are given; and the short notice does not seem to settle satisfactorily either the nature or the structure of the peculiar organs in question. — E. B. [517

VERTEBRATES.

Fatigue and nutrition of the heart. — Gaule has shown that a frog's heart, washed out with dilute solution of common salt until it ceases to beat, is rendered capable of further pulsation when dilute alkaline solutions are sent through it. Martius confirms this, but dissents from Gaule's view, that the alkali nourishes the heart. Its administration leads to a certain number of beats; but these soon cease, and a fresh supply of alkali is then inefficient, while other liquids, especially blood serum, lead to renewed cardiac contractions. Martius concludes that the frog's heart-muscle has in itself no store of energy-yielding material which it can call upon, but works at the expense of food-matters yielded it constantly by the liquid circulating through it. When the heart, irrigated with salt solution, ceases to beat, this is due to the saturation of its tissue with carbon dioxide while still some nutrient matter (blood) remains not washed out from the ventricular network. The salt solution, acting merely as a medium for physical diffusion, cannot remove the carbon dioxide as fast as it accumulates, and consequently the heart ceases to beat while it still has some available food. The alkali, on the other hand, chemically removes the injurious carbon dioxide; and the heart beats for a short time, using the food-stuff in the blood still present in its meshes. When the heart, treated with dilute alkali, ceased to beat, new pulsations could only be obtained when it was supplied with liquids containing serum albumen. Solutions of syntonin, glycogen, peptone, egg-albumen, casein, or myosin, were useless. Gaule had found solution of peptone efficacious. This Martius thinks must have been due to the fact that Gaule used an alkaline solution of that substance, and that the alkali was the efficient element in the liquid. — (*Du Bois' arch.*, 1882, 543.) H. N. M. [518

Influence of different blood-constituents on the beat of the heart. — Ringer withdraws his previous paper (*Journ. of physiol.*, iii.) on this subject in consequence of his discovery that the sodium-chloride solution with which he worked was not prepared, as he had believed, with distilled water. It was made with water supplied by the New river company of London, and containing salts, not only of sodium, but of calcium, magnesium, and potassium. When solution of Na Cl in pure distilled water was used, the results previously obtained failed to appear. On the other hand, the rounding of the apex of the curve of ventricular contraction, the prolongation of the curve, and the slow diastole previously described as due to sodium chloride, are all brought about by solutions of minute quantities of calcium salts in distilled water. A very minute quantity of potassium chloride prevents this effect of the lime-salts. A solution of Na Cl, K Cl, and Ca Cl_2 in distilled water is perfectly neutral, yet makes an excellent artificial circulating liquid for the frog's heart. This shows that alkalinity of the circulating medium is not necessary for contractibility. A lime-salt, the author concludes, is necessary for the manifestation of cardiac contractility; but, in the absence of potassium, calcium so prolongs the diastole as to lead to fusion of the beats, and imperfect action of the heart. Sodium bicarbonate cannot take the place of the lime-salts in maintaining the beat of the heart. — (*Journ. of physiol.*, iv. 291.) H. N. M. [519

Fish.

A remarkable deep-sea fish type. — A fish exhibiting a most remarkable combination of characters has been found by the naturalists of the Travailleur expedition off the coast of Morocco, at a depth of 2,300 met. It has a length of .47 met., and a height of 2 cm., the body tapering backwards like that of a macrurid. The cranial part of the head is short (3 cm. long); but the suspensorium and jaws are excessively elongated, the jaws being 9.5 cm. long. The mouth is consequently enormous. A long, slender style constitutes the upper jaw, and is supposed to represent the intermaxillary alone, or possibly the intermaxillary and maxillary amalgamated. The branchial apertures are represented on each side by "a very small orifice forming a simple, rounded, cutaneous perforation situated towards the level of the termination of the bucco-pharyngeal funnel." No fins are described. But the strangest features are revealed by dissection. The respiratory apparatus presents, it is truly said, a constitution which is at present unique in osseous fishes. We find six pairs of interior branchial clefts, and consequently *five branchiae*, each of which is provided *with a double series of free lamellae*. No hyoidean apparatus is developed. (Perhaps the hyoidean apparatus is represented by the anterior pair of branchial arches.) It is also asserted that there are no opercular pieces. Further, the suspensorium is said to be "composed of only two pieces, — a basal piece, the analogue of the temporal; and an external piece, no doubt representing a tympano-jugal." No pneumatocele was found. The form thus characterized has been named by Vaillant Eurypharynx pelicanoides, and is considered as the type of a new family (the Eurypharyngidae). Not only, indeed, does it represent a new family: its affinities are by no means

obvious. By Vaillant it is thought "that the fish presents relations with the Anacanthini, with certain Physostomi (such as the Scopelidae and Stomiatidae), and also with the Apodes." It has, in fact, features of resemblance with the forms noted, as well as with the Saccopharyngidae, but they are wholly superficial. Assuming, of course, the correctness of the characters attributed to Eurypharynx, we are compelled to regard it as the representative of a primitive type of fishes, and perhaps of a peculiar order related to the dipnoan and ganoid series. The examination of the brain, heart, viscera, and skeleton, especially the skull and scapular apparatus, will doubtless definitely determine its relationships. — (*Comptes rendus*, Dec. 11, 1882; *Ann. mag. nat. hist.* (5), xi. 67.) T. G. [520

Reptiles.

Development of the caudal region in lizards. — H. Strahl publishes a renewed investigation of the development of the neurenteric canal, allantois, and tail, in lizards. His researches were made on Lacerta agilis. The early embryonic disk consists of an anterior field in which the medullary groove is subsequently developed, and a posterior field containing the mass of cells forming the primitive streak. From the ectoderm of the front part of the streak is formed an invagination, which deepens and descends obliquely forwards. For some time the cells lining the invagination do not present a distinctly epithelial character, which leads Strahl to consider this lining mesodermic. The lower wall of the canal, thus formed, breaks through, establishing a connection with the entodermic cavity. The axial row of cells in the dorsal wall of the canal becomes elongated, making a thickened epithelial band, which is the *anlage* of the notochord. This *anlage* gradually extends itself farther forward. The neurenteric canal marks the hind limit of the medullary canal and of the chorda, and moves backward during further growth. It is entirely surrounded by mesoderm of the primitive streak. After the complete closure of the neural tube the neurenteric canal closes also. The primitive streak is directly concerned in the formation of the tail and of the allantois. The latter first appears as a solid mass of cells, which afterwards grows out into the pleuro-peritoneal space, and becomes hollowed. The chorda becomes separated from, and overgrown by, the entoderm, in the same manner as has been previously observed in other vertebrates. The caudal gut (*schwanzdarm*) lasts relatively long. Its communication with the intestine is aborted, but the connection with the neurenteric canal continues longer. Strahl argues against Küpffer's view that the neurenteric canal is directly concerned in the formation of the allantois. He also believes the homology drawn by Balfour between the primitive streak and neurenteric canal on the one hand, and the blastopore of fishes and amphibia on the other, to be erroneous. (His arguments on the latter point seem very defective, nor does he appear to thoroughly grasp the problem.) — (*Arch. anat. physiol.; anat. abth.*, 1882, 242.) C. S. M. [521

Permian reptiles. — Professor E. D. Cope exhibited additional remains of Permian reptiles belonging to the genera Diadectes, Empedias, and Helodectes. The scapular arch of Empedias molaris resembles that of the carnivorous type in having a very small coracoid bone. The episternum is very robust, and, ceasing at the anterior part of the arch, does not separate the clavicles below. The claws approach the ungulate type, and are admirably fitted for digging and shovelling. The vertebrae possess the hyposphen first observed in the Jurassic reptilia. In the Permian diggers this process formed a strong articulation between the vertebrae for the purpose of resisting shock; while, in the swimming Jurassic forms, it served to counterbalance the necessary lightness of the bones. The presence of such a structure in these two very distinct forms of life furnishes an interesting example of the employment of the same means to provide for varying necessities. The basi-occipital presents the usual reptilian articulations, and was lost from the specimens before described, which were supposed to have four articulating facets. — (*Acad. nat. sc. Philad.; meeting* March 13.) [522

Mammals.

Tongue of Perameles; origin of taste-bulbs. — The tongue of Perameles nasuta, a rare marsupial, contains numerous and remarkable sensory organs, which have been investigated by Edward B. Poulton. Towards the base of the tongue are three circumvallate papillae; the taste-bulbs, numbering 700 or more, lying in the papillary wall of the valla. In the papillae and around them are numerous serous glands. The axis of each papilla is formed by large ganglion, which contains only a few but very large cells, and gives off non-medullated fibres to the taste-bulbs. This is an important observation, since in the organs of sight and hearing there always intervene ganglion cells between the sensory apparatus and the central nervous system. May it not be also the case with all the gustatory organs? The taste-bulbs are comparatively simple, and appear to contain only one kind of cell. The fungiform papillae are chiefly arranged on each side in a single, irregular line; they very rarely contain taste-cells; but occasionally a few are found, which may lie close together, but are not united into a distinct taste-bulb. His observations have led Poulton to formulate the following theory of the origin of taste bulbs: the terminal organs in the mouth would be placed like similar organs in the skin; namely, in papillary ingrowths of the *mucosa;* hence the cells would lie together, and, in assuming the columnar form, they would converge towards the outer surface of the skin. The convergence of the cells would soon lead to their union into a bulb. One more step: differentiation of the central and peripheral columnar cells of the bulb would produce the gustatory organ of the higher mammalia. "This account of the origin of taste-bulbs explains one important difference between them and the other structurally related end-organs, as those of the olfactory region, or sacculi and ampullae; i.e., in the fact that the gustatory cells are massed together in little groups surrounded by protective cells, while the auditory cells in the positions above mentioned, and the olfactory cells, are isolated, each being separately protected by columnar cells. This difference, it appears, is simply due to the latter elongating from a tolerably plane surface, while the gustatory cells have elongated from the curved surface of an interpapillary process, . . . and therefore have met and penetrated the surface in a group."

At the sides of the tongue are long filiform papillae with an axial non-medullated nerve; and over the upper surface are very numerous peculiar papillae, of small size, and surrounded on the summit by a ring of fine, hair-like papillae, generally ten in number; but towards the back of the tongue the hairs disappear on the anterior side, and at last, on the papillae farthest back, there are only two hairs left. The top of the main papilla is concave. The author describes the interesting histology of these organs; but for further details we must refer to the valuable original.—(*Quart. journ. microsc. sc.*, xxiii. 69). C. S. M. [523

The arrangement of the turbinal bones in the fissiped carnivores. — E. D. Cope divides this group of mammals into two tribes, according to the arrangement of the turbinals. The Hypomycteri, including the families Cercoleptidae, Procyonidae, Mustelidae, Aeluridae, Ursidae, and Canidae, have the external nostril occupied by the complex maxilloturbinal bone. The Epimycteri, comprising the remaining families, have the external nostril occupied by the inferior ethmoturbinal and the reduced maxilloturbinal. — (*Proc. Amer. philos. soc.*, xx. 1882, 471.) F. W. T. [524

ANTHROPOLOGY.

The prehistoric antiquity of man. — In his recent work (reviewed in this issue) Mortillet says, "Palaeoethnology is the study of the origin and development of humanity, before the occurrence of historic documents. This science is divided into three parts: 1°. The study of tertiary man, or the origin of humanity; 2°. The study of quaternary man, or the development of humanity; 3°. The study of man in the present epoch, the prolegomena or first horizon of history." The following scheme, of which the work is an elaborate development, will convey some idea of the patience and originality of the author, whatever may be our opinion concerning the durability of his work.

Temps.			Age.	Périodes.	Epoques.
Géologie.	Quaternaire.	Actuels. Préhistoriques.	Fer.	Mérovingienne.	Wabenienne, Franque, Burgonde, Germanique.
				Romaine.	Champdolienne. Decadence Romaine.
					Lugdunienne. Beau-temps Romain.
				Galatienne, Étrusque.	Marnienne, Gauloise. 3e Lacustre.
					Hallstattienne, des tumulus. 1re du fer.
			Bronze.	Bohémienne.	Larnaudienne, du marteleur. 2e Lacustre en majeure partie.
					Morgienne, du fondeur. 2e Lacustre partie.
			Pierre.	Néolithique, Pierre polie.	Robenhausienne. 1re Lacustre, des dolmens.
				Paléolithique, Pierre taillée.	Magdalénienne, des Cavernes, en majeure partie, du Renne presque totalité.
					Solutréenne, du renne partie, du mammouths partie.
					Moustérienne, du grand ours des cavernes.
					Chelléenne, Acheuléenne, du mammouths partie, de l'Elephas antiques.
	Tertiaire.			Eolithique, Pierre étonnée par le feu.	Thenaisienne.

On pp. 28 and 29, the eolithic period is tabulated into upper secondary, eocene, miocene, and pliocene, and further subdivided into thirteen epochs. Part I. (chapters i.–xv., p. 25–125) relates to tertiary man; part II. (chapters i.–xxiii., p. 127–476), to quaternary man; and part III. (chapters i.–xii., p. 479–627), to recent man. One feature of the book will be viewed with favor, that is, the addition of the author's name, in parentheses, to significant discoveries; as, Deposits containing gashed bones of Balaenotus (Capellini), Calaveras skull (Whitney), Delaware gravels (Abbott), etc. — J. W. P. [525

The cerebral convolutions of man. — In 1839 Leuret ascertained that the number and the disposition of the primary convolutions of the brain were constant in different species of mammals. Arrested by disease, on his way to the tomb he confided his work to Gratiolet, who, actuated by the comparative method, extended his researches to the entire series of primates, and succeeded in bringing order out of the chaos of convolutions in the human brain. The labors of these two brilliant investigators were followed up by many as talented as they, — such as Arnold, Bischoff, Ecker, Flower, Huschke, Huxley, Marshall, Meynert, Pansh, Rolando, Rolleston, Turner, Vogt, and Wagner, — but by none with more zeal and care than by Paul Broca of Paris. Even from his tomb he reaches forth his hand to cast one more ray of light upon this obscure subject; for we find, in the January number of the *Revue d'anthropologie*, a paper entitled "Elementary descriptions of the cerebral convolutions of man explained by the brain-chart." Broca was nothing if he was not laborious and painstaking. He had hundreds of brains cast. He examined them all to ascertain the forms that were typical. By means of painted casts and charts he taught his pupils the geography of the brain, as one might teach children the map of Europe. He introduced a system of nomenclature for the hemispheres, the fissures, furrows, lobes, convolutions, and branches, so that the student could follow up his work with a description as accurate as that of the anatomist dissecting a bird. Indeed, this paper is a text-book upon human cranio-cerebral topography. — (*Rev. d'anthrop.*, Jan., 1883.) J. W. P. [526

The skulls of criminals. — Drs. Corré and Roussel have communicated to the French anthropological society the results of their researches upon 202 criminals whose crania are preserved in the museum of anatomy at Brest. They have arrived at the following conclusions: —

1. The skull is remarkable in criminals for a horizontal development, generally above the mean.

2. The sub-brachycephalic, brachycephalic, and mesaticephalic types are much more numerous than the dolichocephalic.

3. The proportion of asymmetry is enormous. It varies little in the different categories, and in the whole criminality it amounts to 65.3 to the 100. It is at its maximum (7.05) among those condemned for immorality and rape; at its mimimum (60), among those condemned for attempts upon life.

4. The deformations of the transverse vertical curve are very remarkable among thieves. Among them, as well as on those condemned for attempted violations of virtue, are to be found a certain number of carinated crania.

5. The deformations of the antero-posterior median curve are common in all the groups: they arise mostly from the flattening of the bregma and of the posterior parietal region.

6. These results confirm and complete those already obtained by several investigators (Broca, Bordier, etc.). — (*Revue d'anthrop.*, Jan. 15, 1883.) O. T. M. [527

EARLY INSTITUTIONS.

Our early economic history. — Professor Meitzen of Berlin reviews von Stein's '*Drei fragen des grundbesitzes*,' and takes occasion to say a great deal that is interesting upon the land-question and the past history of land-holding. One or two points may be noted here. Had we space, we should note other points. The article is significant in many ways. Von Stein makes collective possession and ownership of land the starting-point of our economic development; but Prof. Meitzen says, what is certainly true, that, so far back as the time of Tacitus, private property in land existed everywhere. This property consisted regularly of hides, what the Germans call *hufen*. Attached to these hides were shares or rights in the undivided land,— the *almend*. The hides were divisible in the early time. It was during the feudal period that they came to be indivisible. Without doubt the land was common, open to everybody, during the period of migrations,— the nomad period; but this condition of things did not last long. The land in one place supports only a limited number of animals. A large number cannot graze together. Separate districts were accordingly assigned to separate herds, or several small herds together. These herds would belong to different families. While some of these families grew rich and powerful, others grew poor and weak. The latter were driven from their lands, or reduced to dependence and servitude. Then, as there were dependents and slaves to do the work, agriculture arose. Hides were assigned to the cultivators, which were the property of their respective lords. It is probable that the undivided common land was at this time subject to appropriation. Every man could have, therefore, as many hides as he wanted. It was at a later time, probably, that the common land became subject to communal regulations. This is Prof. Meitzen's theory, as we understand it. It is certainly a great advance on the old theory of primitive equality and communism. Prof. Meitzen says, "Es ist also allgemeine gleichheit der alten Germanen eben so fabel wie allgemeine freiheit." — (*Jahrb. nationalökon. stat.*, Jan. 13.) D. W. R. [528

Land-holding in Damaraland. — C. G. Büttner describes how the land is free to everybody; how the individual appropriates as much of it as he pleases, wherever he pleases, provided he does not, in so doing, trespass upon land already appropriated. There are no boundaries between one man's land and another's; only it is generally considered wrong to enter upon land that has been brought under cultivation by another. The chief wealth of the people consists of flocks and herds, which are driven about from place to place by the owners or the herdsmen. Family life is patriarchal. Slavery exists in a mild form. "Whatever a man puts his hands upon, that is his private property." The writer, or his translator, calls this communism! — (*Pop. sc. monthl.*, March, 1883. From *Ausland.*) D. W. R. [529

Slavery in Europe. — M. Fournier gives us a long article upon the liberation of the slaves in western Europe between the fifth and thirteenth centuries. He considers the parts taken by the church and state respectively in this movement, and concludes that the church was far less instrumental in bringing about the abolition of slavery than has been generally supposed. — (*Rev. hist.*, Jan.-Fév., 1883.) D. W. R. [530

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

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Variability of maize. — Were the different forms of ear-corn, raised from seed of uniform appearance, shown to one not acquainted with the variability of maize under hybridization, the collection would be referred to many varieties, and perhaps to several species. Even to one who has made a study of the subject, there is a constant series of surprises. As a slight contribution to the subject of the hybridization of corn, I note the following forms as gathered from a small plat planted with fine, uniform-appearing seed of 'podded' corn from an unknown source.

This podded corn is that curious variety wherein each kernel, as well as the whole spike, is surrounded by a husk. It is known under various names; such as, husk corn, Paraguay corn, Texas corn, wild corn, Oregon corn, etc. The variety planted showed a yellow, dent, elongated kernel, each kernel husked, and of a uniformity which suggested an extreme purity or fixity of type.

The crop harvested yielded: 1°. Tassel-corn, — some of the kernels heavily, others slightly husked, and others bearing, in all but size, a most striking resemblance to sorghum-seed, both in shape and structure, and the husk changed to a glume; 2°. Ears with kernels uniformly and lightly husked; 3°. Ears in which the kernel-husk has increased in abundance and length on successive ears, until at last the husk predominates over kernels; 4°. Ears of husked grain, the rows arranged in pairs, the apex of the husk of each of the rows of each pair facing inward; 5°. Some husked ears, but the kernel-husks pure white in some specimens, tinged with red in others; 6°. Fastigiate ears, i.e., a whole mass of ears, each ear occupying the position of a kernel on the cob, and arranged parallel to each other; 7°. Unhusked corn, — red cob, yellowish-white dent kernel, with a sprinkling of sweet-corn kernels through cross-fertilization; 8°. A dark purplish-red ear of unhusked corn, — a dent corn, mingled with some dark-red kernels of sweet-corn.

Variations equally surprising have occurred with us from a fine-appearing white 'pearl' pop-corn used as seed. From the crop, we selected nine ears, any one of which might well be referred to a distinct variety. Some of the ears formed 'rice-corn,' or the kernels mucronate; other ears had the smooth, round, stony grain of the pearl varieties; other ears had taken on the appearance and size of a field flint-corn. The colors varied from white, through the buffs, to yellow, and from light red to dark red, forming, in the nine specimens, nine different colors or shades. The number of rows also differed, and the size and shape of ear.

In habits of growth, some varieties of corn bear the ears on the nodes quite low down, others on the higher nodes; but no variety, so far as numerous observations extend, bears ears on the five upper nodes of the plant. Yet in individual variations a perfectly husked ear is borne on the first node from the tassel; and even four well-husked ears have been found borne grouped around this first node.

While, normally, ears are produced from the axil of